the Energy to Lead

NGV Tech Forum:
Gas Technology Institute R &D Activities Update

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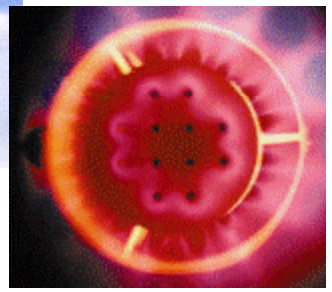
Gas Technology Institute



Solving Important Energy Challenges via:

- > Contract Research
- > Program Management
- > Technical Services
- > Education and Training

> Over 1,000 patents
> Nearly 500 products commercialized

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Facilities & Staff

> Main Facility:

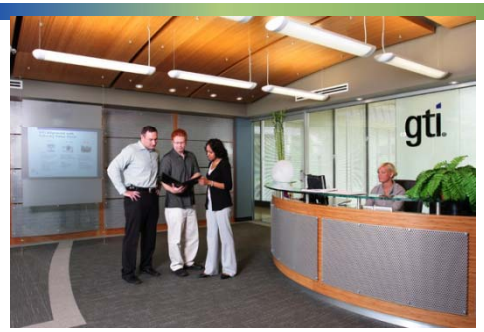
18-Acre Campus

Near Chicago

- Over 200,000 ft^2 of laboratory space
- 28 specialized laboratories and facilities

> Staff of 250

- 70% are scientists and engineers
- 45% with advanced degrees



Offices & Labs

Energy & Environmental Technology Center

Flex-Fuel Test Facility

GTI R&D Activities

Current Areas of Work

- Infrastructure Development
- Engine Testing & Demonstration
- Storage Cylinder Technologies
- Dispensing Technologies
- Analysis & Reporting

CMAQ-City of Chicago Fueling Infrastructure

- Objective: Provide a standard CNG fuel station design for five locations in the Chicago-land area (phase 2).
- 500 gge per day with 50 gge fast-fill capability
- Single meter, dual hose, dual pressure dispenser
- Status:
  - 4 of 5 stations completed

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Phill Home Refueling Field Evaluation

- Objective: Support the market introduction of FuelMaker's Phill Home Refueling Appliance through validation testing and communications.

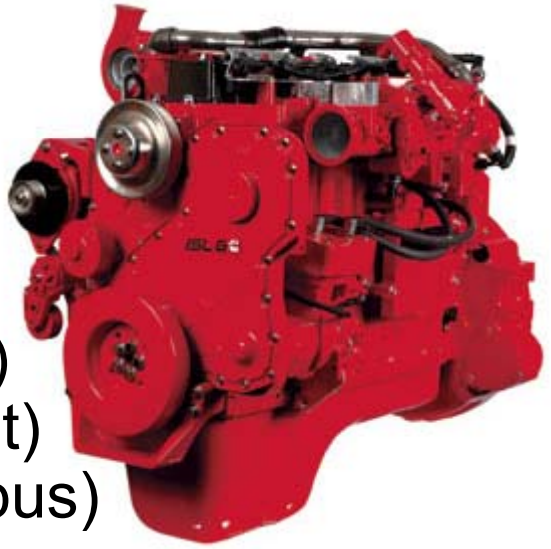
- Status:
  - Designed, programmed, and fabricated data logging devices
  - Installed 6 Phil units with data loggers
  - Collected 12 months of operating data
  - Analyzed and evaluated for energy efficiency, reliability, user satisfaction, cost of operation, and fueling patterns.
  - Final Report – Completed August 2008

Biomethane Landfill Gas to LNG for Transportation Fuel

- Objective: First US deployment of GTI's small-scale LNG production technology licensed to Linde/BOC.
- Status:
  - Altamont site selected in Livermore, CA in partnership with Waste Management
  - 13,000 gallons per day design complete
  - Equipment on order
  - Ground breaking Dec '08
  - Start up target May '09

Field Test of CWI ISL G Engine

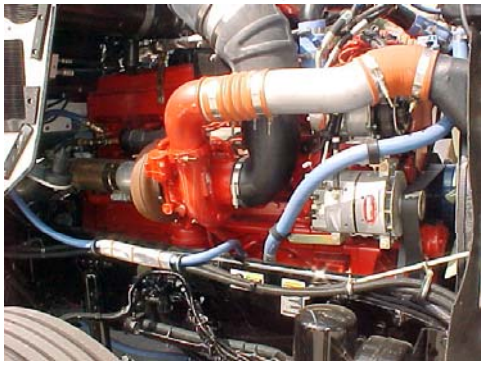
- **Objective:** Obtain engine operating experience and data from a variety of operational environments prior to commercial release of the ISL G engine



- **Status:**
  - Field test including 6 test sites
    - LA County MTA (60 ft articulated)
    - Valley Metro, Phoenix (40 ft transit)
    - Pierce Transit, Tacoma (40 ft transit)
    - Denver International Airport (40 ft bus)
    - City of LA (refuse collection truck)
    - Waste Management, Santa Ana (refuse truck)
  - Began 2Q-2006, Field Report complete 3Q-2007

Westport Innovations Inc.
High Pressure Direct Injection

- Objective: Field test evaluation of class 8 natural gas fueled trucks powered with HPDI.



- Status:
  - Cost share provided to Westport (started 2006)
  - Five converted trucks in service at LA County Sanitation District (Cummins ISX in Kenworth T800 with LNG)
  - Phase 1 describing engine performance and reliability-completed
  - Phase 2 to evaluate demonstration vehicle is beginning in 2009

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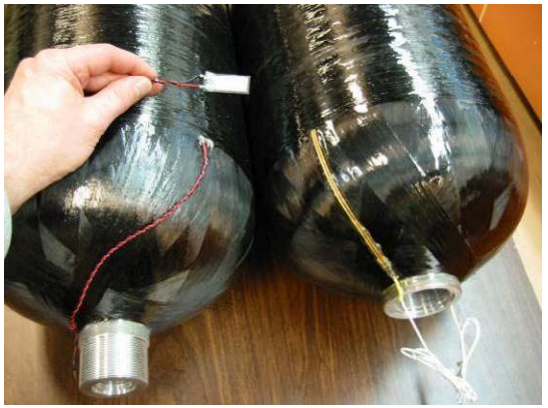
Cummins Westport Inc. Fuel Tolerance

- Objective: Increase the fuel tolerance of the CWI ISL G engine, Enabling the engine to operate on low (65) Methane Number fuel.
- Status:
  - Detailed plan developed
    - Phase 1-Technology Development (*Stage 3) of* 65 MN ISG L engine
    - Phase 2- Product Development (*Stage 4)* of 65 MN engine to begin in early 2009

Non-Destructive Evaluation for Gas Storage Vessels

- Objective: Develop an active system to monitor damage to high pressure composite cylinders which would be applicable to:
  - Bulk gas transport
  - Stationary bulk gas storage
  - On-board gas vehicle fuel containers



- Status:
  - Schematics and preliminary PCB made
  - Proof of concept completed
  - Final Report issued July 2008
  - Needs further development followed by full scale trials

Low Cost & Scalable CNG Cylinder

- Objective: Assist HyPerComp Engineering Inc. in product development & commercialization stages of:
  - Type 4 all-composite cylinder
  - 18” x 47”-13 gge, scaled to 15, 17, & 7 gge
  - Targeting a market introduction price at $115 per gge stored
- Status:
  - 13 gge design -completed and documented
  - Fabrication of 22 cylinders for NGV2 certification testing-completed June 2008
  - 3rd Party Certification Testing underway

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HCNG- Natural Gas/Hydrogen Blends

- Objective: Investigate the best methods of blending natural gas and hydrogen gases at the fueling station.
- Status:
  - Patent and literature search
  - Modeling of blending options
  - Investigate unique approach using GTI's Accufill®
  - Evaluate and report on options and equipment recommendations
  - Phase 2 (not funded yet)- develop prototype and lab test followed by field demonstration

NGV Strategy Planning Support

- Objective: Produce deliverables of value to Alagasco for assessing the current state of the natural gas vehicle (NGV) industry and to provide guidance in evaluating business opportunities the NGV market may represent for their organization.
- Status:
  - Quick turn around study from an LDC's perspective
  - National, Regional, Local market issues being summarized
  - Report due December 2008

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